cont a3

determining at least one notch filter parameter based on the candidate frequency bin.

Please replace claim 6 with the following:

a4

6. The method of claim 1 wherein the adjusting step comprises:

setting the at least one notch filter to a candidate frequency;

setting the at least one notch filter to a bandwidth surrounding the candidate frequency, and

setting the at least one notch filter to a predetermined notch depth.

Please add the following claims:

a5

7. A method of reducing unwanted acoustical feedback in a space having at least one microphone for transducing acoustic signals into electrical input signals and at least one speaker for transducing electrical output signals into acoustic signals, the method comprising:

converting the electrical input signals to corresponding digital input signals;

examining the digital input signals for at least one candidate signal of unwanted acoustical feedback;

adjusting at least one digital filter in response to a detection of the at least one candidate signal;

processing the digital input signals through the at least one digital filter to generate digital output signals;

converting the digital output signals to electrical output signals;

testing the electrical output signals by broadcasting the electrical output signals through the speaker to generate new input signals and analyzing the effect of processing the digital input signals; and

readjusting the at least one digital filter by decreasing a depth of the at least one digital filter if the magnitude of the at least one candidate signal is not reduced by the

predetermined amount, such that the unwanted acoustical feedback in the space is reduced.

8. The method of claim 7 wherein the readjusting step further comprises increasing the depth of the at least one digital filter if a magnitude of the at least one candidate signal is reduced by a predetermined amount.

Cont'd A5

9. The method of claim 7 wherein the converting the electrical input step also comprises:

transforming the digital input signals into a frequency spectrum to produce a plurality of bin values wherein each bin value represents a function of an amplitude of the digital input signals across a frequency spectrum bandwidth.

10. The method of claim 9 wherein the function is a sum of a square of a real component of the amplitude and a square of an imaginary component of the amplitude.

11. The method of claim 9 wherein the function is a square root of a sum of a square of a real component of the amplitude plus a square of an imaginary component of the amplitude.

12. The method of claim 9 wherein the examining step further comprises:

establishing a set of candidates comprising a predetermined number of bin values with largest magnitudes,

testing each candidate in the set of candidates by determining an acoustical significance of each candidate and removing the respective candidate from the set of candidates if the respective candidate is not acoustically significant, and

determining the at least one candidate signal from the set of candidates.

13. The method of claim 12 wherein determining the acoustical significance comprises:

determining an average value which is a function of the magnitudes of the plurality of bin values;

comparing the bin value of each candidate in the set of candidates to an absolute value and removing the respective candidate from the set of candidates if the respective bin value of the respective candidate is less than the absolute value; and

comparing the bin value of each candidate to a relative value, and removing the respective candidate from the set of candidates if the bin value of the respective candidate is less than the relative value, wherein the relative value is a function of the average value and a relative multiplier.

14. The method of claim 13 wherein the relative multiplier is a function of the magnitudes of the plurality of bins.

15. The method of claim 12 wherein the magnitudes are calculated by a process which includes:

transforming the digital input signals into a frequency spectrum to generate a plurality of new bin values wherein each new bin value represents the function of an amplitude of the digital input signals across the frequency spectrum bandwidth,

comparing a new bin value to the bin value,

setting the bin value to the new bin value when the bin value is less than or equal to the bin value, and

setting the bin value to a filtered value when the new bin value is greater than the old bin value.

16. The method of claim 15 wherein the filtered value is calculated by:

Filtered Value = (bin value – previous bin value)*K + previous bin value

Where K is a filtering coefficient.

17. The method of claim 16 wherein the filtering coefficient (K) is calculated by:

$K = 1 - (\text{Threshold})\,(1/t^{*}Ffs)$

Where t is a required response time, the Threshold is a fractional value of the target magnitude for which a time value is calibrated, and Ffs relates to an interval rate.

18. The method of claim 17 wherein the time value varies according to the frequency relating to the respective bin value.

19. A method of reducing unwanted acoustical feedback in a plurality of sound signals, the method comprising:

sampling the plurality of sound signals at predetermined intervals to create a set of sampled sound signals;

transforming a sound signal from the set of sampled sound signals, to a frequency spectrum comprising a plurality of frequency bins, each bin having a bin value which is a function of a magnitude of a frequency of the sound signal over a predetermined frequency width;

comparing each bin value to a previously stored bin value;

setting the previously stored bin value to the new bin value when the new bin value is less than or equal to the stored bin value;

setting the previously stored bin value to a filtered value when the new bin value is greater than the stored bin value;

selecting a set of candidate frequencies from the previously stored bin values having the largest values;

testing an acoustic significance of each candidate frequency in the set of candidate frequencies and removing the respective candidate frequency from the set of candidate frequencies if the respective candidate is not acoustically significant, such that at least one candidate feedback frequency is determined;

adjusting at least one notch filter to filter the at least one candidate feedback frequency;

processing the plurality of sound signals through at least one notch filter; and

readjusting the at least one notch filter to filter for the at least one candidate feedback frequency wherein the at least one notch filter's depth is decreased if the at least one candidate feedback frequencies has not been reduced by a predetermined amount, such that unwanted acoustical feedback is reduced.

20. The method of claim 19 wherein the readjusting step further comprises increasing the at least one notch filter's depth if the at least one candidate feedback frequency has been reduced by a predetermined amount.

cont'd a5

21. The method of claim 19 wherein the testing an acoustical significance comprises:

determining an average value which is a function of an average of the plurality of bin values;

comparing the bin value of each candidate frequency in the set of candidate frequencies to an absolute value and removing the respective candidate frequency from the set of candidate frequencies if the respective bin value of the respective candidate frequency is less than the absolute value; and

comparing the bin value of each candidate frequency to a relative value, and removing the respective candidate frequency from the set of candidate frequencies if the bin value of the respective candidate frequency is less than the relative value, wherein the relative value is a function of the average value and a relative multiplier.

22. The method of claim 21 wherein the relative multiplier is a function of the magnitudes of the plurality of bins.

23. The method of claim 19 herein the filtered value is calculated by:

Filtered Value = (bin value – previous bin value)*K + previous bin value

Where K is a filtering coefficient.

24. The method of claim 23 wherein the filtering coefficient (K) is calculated by:

K = 1 - (Threshold) (1/t*Ffs)

Where t is a required response time, the Threshold is a fractional value of the target magnitude for which a time value is calibrated, and Ffs relates to an interval rate.

25. The method of claim 24 wherein the time value varies according to the frequency relating to the respective bin value.

26. A system for reducing unwanted acoustical feedback comprising:

at least one processor;

at least one memory accessible to the processor; and

programming comprising instructions for:

examining the digital input signals for at least one candidate signal of unwanted acoustical feedback;

adjusting at least one digital filter in response to a detection of the at least one candidate signal;

processing the digital input signals through the at least one digital filter to generate digital output signals;

converting the digital output signals to audio output signals;

testing the audio output signals by broadcasting the audio output signals through the speaker to generate new audio input signals and analyzing the effect of processing the digital input signals; and

readjusting the at least one digital filter by decreasing the depth of the at least one digital filter if the magnitude of the at least one candidate signal is not reduced by the predetermined amount, such that the unwanted acoustical feedback in the space is reduced.

27. The system of claim 26 wherein the readjusting instructions further comprise increasing the at least one notch filter's depth if the at least one candidate feedback frequency has been reduced by a predetermined amount.

28. The system of claim 26 wherein the programming further includes instructions

for:

transforming the digital input signals into a frequency spectrum at an interval rate to produce a plurality of bin values wherein each bin value represents a function of an amplitude of the digital input signals across a frequency spectrum bandwidth.

29. The system of claim 28 wherein the function is a sum of a square of a real component of the amplitude and a square of an imaginary component of the amplitude.

cont a5

30. The system of claim 28 wherein the function is a square root of a sum of a square of a real component of the amplitude and a square of an imaginary component of the amplitude.

31. The system of claim 28 wherein the software includes instructions for:

establishing a set of candidates comprising a predetermined number of bin values with the largest magnitudes,

testing each candidate in the set of candidates by determining the acoustical significance of each candidate and removing the respective candidate from the set of candidates if the respective candidate is not acoustically significant, and

determining the at least one candidate signal from the set of candidates.

32. The system of claim 31 wherein the instructions for determining the acoustical significance comprises:

determining an average value which is a function of an average of the plurality of bin values;

comparing the bin value of each candidate in the set of candidates to an absolute value and removing the respective candidate from the set of candidates if the respective bin value of the respective candidate is less than the absolute value; and

comparing the bin value of each candidate in the set of candidates to a relative value, and removing the respective candidate from the set of candidates if the bin value

of the respective candidate is less than the relative value, wherein the relative value is a function of the average value and a relative multiplier.

33. The system of claim 32 wherein the relative multiplier is a function of the number of the plurality of bins.

34. The system of claim 31 wherein the magnitudes are calculated by instructions which includes:

comparing each bin value produced for one interval to a previous bin value produced for a previous interval;

setting the previous bin value to the respective bin value when the respective bin value is less than or equal to the previous bin value;

setting the previous bin value to a filtered value when the respective bin value is greater than the previous bin value; and

setting the respective magnitude to the previous bin value.

35. The system of claim 34 wherein the filtered value is calculated by:

Filtered Value = (bin value – previous bin value)*K + previous bin value

Where K is a filtering coefficient.

36. The system of claim 35 wherein the filtering coefficient (K) is calculated by:

K = 1 - (Threshold) (1/t*Ffs)

Where t is a required response time, the Threshold is a fractional value of the target magnitude for which a time value is calibrated, and Ffs relates to an interval rate.

37. The system of claim 36 wherein the time value varies according to the frequency relating to the respective bin value.

38. An apparatus for reducing unwanted acoustical feedback in a space having at least one microphone for transducing acoustic signals into electrical input signals and at

least one speaker for transducing the electrical output signals into acoustic signals, the apparatus comprising:

an analog-to-digital converter which converts the electrical input signals to digital input signals;

at least one processor coupled to the analog-to-digital converter;

a memory accessible to the processor for storing software modules, including an examining module to examine the digital input signals for candidate feedback frequencies,

at least one digital notch filter implemented in the at least one processor which processes the digital input signals and wherein the processor determines parameters for the at least one digital filter in response to a detection of at least one candidate frequency in the digital input signal,

a digital to analog converter coupled to the processor for converting the digital output signals to electrical output signals, and

a testing module which decreases the notch depth parameter if the magnitude of the at least one candidate frequencies is not reduced by a predetermined amount.

39. The apparatus of claim 38 wherein the testing module examines the audio output signals and increases a notch depth parameter for the at least one digital filter if the magnitude of the at least one candidate frequency is reduced by a predetermined amount.

40. The apparatus of claim 38 further comprising instructions which transform the digital input signals into a frequency spectrum to produce a plurality of bin values in the memory wherein each bin value is a function of an amplitude of the frequency spectrum for that bin.

41. The apparatus of claim 40 wherein the function is a sum of a square of a real component of the amplitude and a square of an imaginary component of the amplitude.

42. The apparatus of claim 40 wherein the function is a square root of a sum of a square of a real component of the amplitude and a square of an imaginary component of the amplitude.

43. The apparatus of claim 40 further comprising:

a module for determining a set of candidates representing the largest values; and

a candidate testing module which tests each candidate in the set of candidates to determine the acoustical significance of each candidate.

44. The apparatus of claim 43 wherein the parameters for the digital filter are determined from the set of candidates.

45. The apparatus of claim 43 wherein the candidate testing module includes:

an averaging module which reads the value of each bin and calculates an average for the plurality of bins.

a comparing module which compares each candidate in the set of candidates to a predetermined value, and eliminates the respective candidate from the set of candidates if the candidate is less than the predetermined value, and compares each candidate to a relative value, and eliminates the candidate from the set of candidates if the candidate is less than the relative value, wherein the relative value is a function of the average and a relative multiplier.

46. The apparatus of claim 45 wherein the relative multiplier is a function of the magnitudes of the bins.

47. The apparatus of claim 43 further comprising a calculating module for:

repeating instructions in the transformation module to generate a plurality of new bin values,

comparing a new bin value to the bin value;